A

DISCOURSE

DELIVERED AT

The ROYAL SOCIETY, Nov. 30, 1773.

A

DISCOURSE

ON THE

Different Kinds of Air,

DELIVERED AT THE
Anniverſary Meeting of the ROYAL SOCIETY,
November 30, 1773.

By Sir JOHN PRINGLE Bar^{t}. PRESIDENT.

PUBLISHED AT THEIR REQUEST.

LONDON:
Printed for the ROYAL SOCIETY.
MDCCLXXIV.

GENTLEMEN,

IT it is with great ſatisfaction I enter upon this part of my office—to confer, in your name, the prize-medal of this year upon a Member of this Society ſo worthy of that diſtinction.

The object which Sir Godfrey Copley, founder of the benefaction, had in view, and in what manner the original pecuniary reward was converted into this more liberal form, having been ſo lately explained by my honoured predeceſſor; I need only obſerve, that though your Preſident and Council have been entruſted with the ſole power of adjudging this premium, yet they have now, as, I am perſuaded, they have had on former occaſions, the greateſt ſolicitude to nominate that perſon, who, in their opinion, would have obtained all your ſuffrages.

In confidence of this unanimity, it is with ſingular pleaſure I acquaint you, that the Reverend JOSEPH PRIESTLEY; Doctor of Laws, has been found at this time the beſt entitled to this public mark of your approbation, on account of the many curious and uſeful experiments contained in his *Obſervations on different kinds of Air*, read at the Society in March 1772, and inſerted in the laſt complete volume of your Tranſactions [*a*]. And indeed, GENTLEMEN, when you reflect on the zeal which our worthy brother has ſhewn to ſerve the public and to do credit to your inſtitution, by his numerous, learned, and valuable communications, you will, I imagine, be inclined to think that we have been rather ſlow than precipitate in acknowledging ſo much merit.

[*a*] Vol. 62.

Your time will not allow me to touch on the ſubjects of his former Papers [b]; nay I apprehend I ſhall even treſpaſs upon it, by recalling to your memory only a few of thoſe intereſting diſcoveries which Doctor PRIESTLEY has made in theſe *Obſervations*: ſince in doing juſtice to others, as well as to him, it will be proper to remind you of the progreſs that had already been made in this part of ſcience by men of the greateſt abilities in their time, and by other ingenious perſons ſtill among us.

THERE is not perhaps any branch of Natural Philoſophy that has more engaged the attention of the learned, or been more ſucceſsfully cultivated, than the nature of the common air. The knowledge how indiſpenſable it is to the preſervation of animals, muſt have been coeval with mankind: it was from the beginning, as now, *the breath of life*. It was found likewiſe to be a neceſſary ſupport of fire, and that the vegetable creation, deprived of it, languiſhed and died. Nor did the ancient phyſicians fail to diſtinguiſh, at leaſt attempt to diſtinguiſh, between the effects of an air too hot and one too cold, an air too moiſt and one too dry, and between an inſalutary and a wholeſome air.—Thus far the experience, or the theory of all ages.—But the leſs obvious properties of this element, its gravitation and its elaſticity, with their long train of conſequences, remained unknown, till, about the beginning of the laſt century, Lord BACON and GALILEO, in that dawn of philoſophy which they themſelves diffuſed, began the inquiry. The former from experiments aſcertained the elaſticity of the air, and upon that principle conſtructed his *vitrum calendare*, the firſt thermometer [c]. The latter diſcovered that air had weight: but though that ornament of Italy was not ignorant of the limited ſuction of a pump, yet to account for the riſe of the water ſo far in it, he ſtill had recourſe to Nature's *abhorrence of a void* [d].

---

[b] In Phil. Tranſ. vol. 58, 59, 60.

TORRICELLI, at laſt, the diſciple of GALILEO, by one happy and deciſive experiment diſcovered the preſſure of the atmoſphere; and PASCAL obſerved, that this preſſure varied according to the heights he carried his barometer

---

[c] Bac. Nov. Org. lib. 2. aph. 13.
[d] Dialog. 1.

ter [*e*]. Soon after followed the air-pump, the invention of the celebrated Otto de Guerick; which though at firſt a rude and imperfect inſtrument, yet improved by himſelf [*f*], and more by Mr. Boyle and Dr. Hook (two of the illuſtrious fathers of this Society) it ſoon became in the hands of Mr. Boyle the means of opening the richeſt mines of natural knowledge. In this reſearch, the Hiſtory of the common air, he ſeemed ſo far to carry his inquiries, as to leave little to be done by others who ſhould come after him; thoſe parts excepted depending on geometry and calculation [*g*]. How ſucceſsfully theſe were executed by Dr. Halley and Sir Isaac Newton, I ſcarce need mention; nor the ſolid foundation on which thoſe great men eſtabliſhed the rarefaction of the air; and in what proportion, according to its diſtance from the earth [*h*]. But it was

---

[*e*] Traité ſur l'Equilibre des Liq.

[*f*] Gaſpar. Schott. De Arte Mechan. Hydr. Pneumat. Exp. nova Magdeburg.

[*g*] Boyle, Phyſico-mechan. Exp. & Mem. for a Gen. Hiſt. of the Air.

[*h*] Phil. Tranſ. N° 181. p. 104. Abrid. vol. 2. p. 14. Phil. Nat. Princ. Math. lib. 2. prop. 22, 23.

Sir ISAAC NEWTON alone, who, upon the principle of the air's being compreſſed by the power of gravity, and that of its elaſticity, taught that tremulous bodies would communicate their motion to the air, and thereby excite vibrations in it, ſpreading every where. Thus he diſcovered the efficient cauſe of ſounds [*i*].

But before this period Mr. BOYLE obſerving, as he himſelf informs us, how much air was concerned in many of the *phænomena* of Nature, and how neceſſary it was to the exiſtence of animals, became ſolicitous to inquire, whether a fluid of ſo great importance were not produceable by art; if ſo, he believed that ſuch air might be ſerviceable in life, particularly in the art of diving, and in *ſubmarine navigation* [*k*]. With theſe views that admirable Naturaliſt ſet about making ſome new experiments, and from a variety of bodies, by different proceſſes, obtained a pneumatical fluid (from ripe fruit, fermenting and effervеſcing liquors, and from the putrefaction

---

[*i*] Phil. Nat. Princ. Mat. lib. 2. prop. 43.

[*k*] An attempt of Cornelius Drebell to make a veſſel to row under water with men in it. See Boyle's works, vol. 1. p. 69. vol. 3. p. 174.

of

of animal and vegetable ſubſtances) anſwering, till then, his only criterion of air, in being of a durable elaſtic nature [l]. Yet after all, Mr. BOYLE found that theſe new productions were eſſentially different from common air; as they preſently extinguiſhed flame, and ſuffocated thoſe animals that breathed in them. But though he miſſed finding what he ſo much wanted, his labour was not in vain; philoſophy was enriched with the knowledge of what he called *factitious* or *artificial* air, which has in the end proved as uſeful as he wiſhed, in explaining ſeveral natural appearances, and in being ſubſervient to the wants of man.

But this diſcovery, however intereſting to the Naturaliſt, to the Chemiſt in particular [m], ſeems to have been little attended to, till in the beginning of this century Sir ISAAC NEWTON obſerved, that though true permanently elaſtic air ariſes from bodies by heat and fermentation, and that though thoſe aërial particles recede from one another with the greateſt repulſive force, yet they are brought again together;

---

[l] Boyle's works, vol. 4. p. 206, and ſeq.

[m] Hales Stat. Eſſ. vol. 1. ch. 6. p. 317.

gether; and that denſe bodies by fermentation rarefy into ſeveral ſorts of air, which without it returns into denſe bodies [*n*]. Excited by ſuch authority, the Reverend Doctor HALES (whoſe philoſophic and amiable qualities are ſtill freſh in the memory of ſeveral gentlemen preſent) reſuming thoſe experiments concerning the ſeparation of air from bodies, confirmed and extended the diſcoveries of Mr. BOYLE; ſhewing not only that air entered into the compoſition of moſt bodies, but the very proportion it bore to the reſt of the compound, and that often to an amazing quantity [*o*]. Dr. HALES likewiſe examined the mineral waters, eſpecially thoſe of Pyrmont, and finding them abounding with air, to that circumſtance he aſcribed the ſpirit and briſkneſs of thoſe fountains. But that excellent author did not ſeem to apprehend, that in this, as in other inſtances, the air which he produced was not the common air, but, if I may be allowed the expreſſion, the *factitious* air of Nature; as being of the ſame ſort with what Mr. BOYLE had extracted from fermenting and efferveſcing liquors; nay the ſame with the *mephitis* or deadly vapour of the ancients, or the *moſeta* of the modern Italians, ſo frequently met with in the caverns, ſprings, and lakes of their country: and the ſame with the *ſtith* or *choak-damp* in our coal-pits, ſo often fatal to the miners. It muſt be owned it was hard to conceive, how theſe ſprings ſhould owe their prime virtues to what, in another manner of application, Dr. HALES ſaw was ſo deſtructive of vitality.

[*n*] Optics, Quer. 31.

[*o*] Stat. Eſſ. vol. 1. ch. 6.

Now this notion concerning the impregnation of the mineral waters by the *mephitis*, was, as far as I know, originally ſuggeſted by a foreign Member, Dr. SEIP of Pyrmont, firſt in a treatiſe he publiſhed in the German language, and afterwards in a communication to this Society, in the year 1736, in which he deſcribes a ſmall cavern at Pyrmont, ſimilar to the *grotta de' cani*, near Naples [p]. But when this ingenious author calls that *mephitis* (which is a durably elaſtic fluid *ſui generis*) a *ſulphureous ſteam*, or a *ſulphureo-ſpirituous vapour*, he appears to have been imperſectly acquainted with its nature; which is now found to conſiſt of nothing inflammable or ſulphureous, and to be of a denſity or ſpecific gravity conſiderably greater than that of common air.

---

[p] Phil. Tranſ. N° 448. Abridg. vol. 8. p. 659.

Thus the fuller diſcovery of this principle we owe to Dr. BROWNRIGG of White-haven, who, about thirty years ago, began clearly to unfold this myſtery. But thoſe curious papers were not then inſerted in the Tranſactions, as the too modeſt author had requeſted a delay, till he ſhould be able to make them more worthy of that honour. In that communication he remarks, "That a more intimate acquaintance with thoſe noxious airs in mines, called *damps*, might lead to the diſcovery of that ſubtile principle of mineral waters, known by the name of their *ſpirit*; that the mephitic exhalations, termed the *choak-damp*, he had found to be a fluid permanently elaſtic; and from various experiments he had reaſon to conclude that it entered the compoſition of the waters of Pyrmont, Spa, and others; imparting to them that pungent taſte, from which they were denominated *acidulæ*, and likewiſe that volatile principle,

principle, on which their virtues chiefly depend [q]."

In order to aſcertain a fact of ſo much conſequence, Dr. BROWNRIGG took the opportunity, when at Spa ſeveral years after, to make ſome experiments for this purpoſe; when he had the ſatisfaction to find thoſe waters pregnant with the *artificial* or *factitious* air of Mr. BOYLE, the ſame with that of the ſuffocating *grotta* near Naples, and the ſame with the *choak-damp* of our coal mines; for as much as this air inſtantly extinguiſhed flame, and the life of thoſe animals he had incloſed in it [r]. The ſucceſs of this worthy member, in thus far analyzing thoſe waters, encouraged others to purſue the inquiry; and to inveſtigate the manner in which Nature alſo furniſhed them with the chalybeate principle [s]. Mr. LANE therefore, in conſequence of a converſation with Dr. WATSON junior (both of this Society), upon an experiment of Mr. CAVENDISH's, by which that gentleman had found the mephitic air (ſuch as Dr. BROWNRIGG had detected in Spa-water)

---

[q] Vid. Phil. Tranſ. vol. 55. p. 236. & ſeq.

[r] Ib. p. 218. & ſeq.

[s] More properly, the *iron-principle*.

ſufficient

ſufficient to diſſolve any calcarious earth [*t*]: in conſequence, I ſay, of this converſation, wherein it was ſurmiſed, that the ſame mephitic air might likewiſe diſſolve iron in common water, he made the experiment with air taken from Spa water, and happily ſucceeded [*u*]. By this means the nature of the metallic principle in mineral waters was clearly explained; and the whole analyſis of thoſe celebrated fountains, ſo often attempted by Chemiſts and others, and ſtill eluding their laboured reſearches, was thus in the moſt ſimple manner brought to light.

Nothing now ſeemed to be wanting to the triumph of Art, but an eaſy manner of joining, as there ſhould be occaſion, one or both of theſe principles to common water; in order to improve upon Nature, in the more extenſive uſe of her medicine. This was effected by Dr. PRIESTLEY, after ſome other important diſcoveries had been made in this part of pneumatics, firſt by Dr. BLACK, Profeſſor of Chemiſtry at Edinburgh, and then by Mr.

[*t*] Phil. Tranſ. vol. 57. p. 92. & ſeq.
[*u*] Ib. vol. 59. p. 216. & ſeq.

CAVEN-

Cavendish of this Society. The former has ſhewn that a particular ſpecies of factitious air (he calls it *fixed)* adheres to all calcarious earths, magneſia, and alcaline ſalts, with different degrees of force; and that this fluid can be ſeparated from theſe ſubſtances, and combined again with them, in the ſame manner as an acid. Upon this diſcovery he explained in a clear and ſimple manner many appearances in Chemiſtry, till then deemed the moſt unaccountable. Such was the effervеſcence of abſorbent earths and alkaline ſalts with acids, and the change of the mild calcarious earths into quick lime by heat (in conſequence of the expulſion of this *fixed* air which neutralizes them) [*w*]. I muſt add, that I have been well informed, that for ſeveral years paſt the learned Profeſſor has taught, that the air which unites with alkaline ſubſtances is of the ſame nature with the *mephitis*, or ſuffocating air of the *grotta de' cani* and mines; the ſame with what is emitted from vegetables in fermentation; and that in ſome reſpects it agrees with the air which has been injured by the breath of animals, or by the burning of fuel: and laſtly, that the air or elaſtic fluid ariſing from the ſolution of metals by acids is very different from the former.

[*w*] Eſſ. and Obſerv. Phyſ. & Liter. vol. 2. p. 157. & ſeq.

Mr. CAVENDISH has made ſeveral valuable additions to theſe diſcoveries, not only with regard to that ſpecies of *factitious* air the Profeſſor had denominated *fixed air*, but to other elaſtic fluids. He has with accuracy aſcertained the ſpecific gravity of this fixed air, as expelled from alkaline ſubſtances by acids, or from vegetable matter by fermentation; and has demonſtrated the ſimilarity of airs produced by either of theſe two ways. He has confirmed Dr. BLACK's account of the quantity of the fixed air contained in alkaline ſalts and in alkaline earths. He has ſhewn that this fluid can be mixed with water, and in what proportion; and that it flies off again from the water upon heating it, or expoſing it to the common air. Laſtly, that this ſpecies of factitious air imparts to the water the power of diſſolving abſorbent earths; the experiment, as I obſerved before, which led to the knowledge, how Nature infuſed the metallic principle into what are commonly called the *chalybeate waters* [*x*].

Of all theſe facts Dr. PRIESTLEY has carefully availed himſelf. For having learned from Dr. BLACK that this fixed or mephitic air could in great abundance be procured from chalk, by means of diluted ſpirit of vitriol [*y*]; from Dr. MACBRIDE, that this fluid was of a conſiderable antiſeptic nature [*z*]; from Mr. CAVENDISH, that it could in a large quantity be abſorbed by water [*a*]; and from Dr. BROWNRIGG, that it was this very air which gave the briſkneſs and chief virtues to the Spa and Pyrmont waters [*b*]: Dr. PRIESTLEY, I ſay, ſo well inſtructed, conceived that common water impregnated with this fluid alone might be uſeful in medicine, particularly for Sailors on long voyages, for curing or preventing the Sea-ſcurvy. This, we know, is a putrid diſtemper requiring all the antiſeptic quality of thoſe mineral waters, without the chalybeate principle, which might injure by overheating the blood, too much diſpoſed to inflammation. For this purpoſe he made a ſimple apparatus for generating this ſpecies of air from chalk and mixing it with water, in ſuch quantities, and in ſo ſpeedy a manner, that having exhibited the experiment before this Society and the College of Phyſicians, it met with ſo much approbation, that, in order the Public might the ſooner reap the benefit of it, he was induced to detach this part of his labours, and in a ſeparate Paper to preſent it to the Admiralty [*c*].

[*x*] Phil. Tranſ. vol. 56. p. 141. & ſeq.

[*y*] Eſſ. and Obſerv. Phyſ. & Liter. loc. cit.

[*z*] Experim. Eſſ. *paſſim.*

[*a*] Phil. Tranſ. vol. 56. p. 161. & ſeq.

[*b*] Phil. Tranſ. vol. 55. p. 218. & ſeq.

The reſt of his obſervations upon the different kinds of air, addreſſed to the Society [*d*], contain ſo much matter, that I will not preſume to encroach ſo far on your time, as to offer even a ſhort abſtract of the whole; but ſhall be ſatisfied to ſingle out a few of thoſe many diſcoveries, ſuch as are the moſt ſtriking, either for their immediate uſe in life, like that above; or for the explanation of ſome of the more intereſting appearances in Nature.

[*c*] A pamphlet intituled Directions for impregnating water, &c.

[*d*] Phil. Tranſ. Vol. 62.

I come therefore to another ſpecies of *factitious* air, called the *inflammable*. Till within theſe few years little more was known, than that this kind of ſubtile fluid was found in mines, in neglected privies and common ſewers; but chiefly in coal-pits, where it is called the *fire-damp*, making ſometimes formidable exploſions, and indeed often fatal to the miners. I do not recollect that Mr. BOYLE has taken any other notice of it [e]. But about 40 years ago Sir JAMES LOWTHER Baronet, favoured the Society with an account ſomewhat more particular of this production of his coal-mines in Cumberland, accompanying it with ſeveral bladders filled with that fluid, which in this houſe burnt as readily, as at its ſource a month before. Yet ſtill this extraordinary ſubſtance was conſidered more as an object of curioſity, than as one of philoſophical inquiry, till Mr. CAVENDISH began to make experiments upon it; by which, and the conſequences drawn from them, he has added another conſiderable branch to the doctrine of aërial fluids.

---

[e] Boyle's Works, vol. 3. p. 101. vol. 5. p. 305, 306.

Firſt, he has taught how to produce at will, and in great abundance, this other permanently elaſtic fluid from three metallic bodies, Zinc, Iron, and Tin, by diſſolving them in the diluted vitriolic acid, or ſpirit of ſea-ſalt. This ſpecies of factitious air he has ſhewn to be ſurprizingly light, being no more than the tenth part of the weight of common air, and therefore totally different from the *mephitis*, that other ſpecies of factitious air we have been treating of, and which, as was obſerved, is heavier than the air of our atmoſphere. Laſtly, Mr. CAVENDISH has given ſeveral experiments upon the inflammability of various mixtures of this fluid with common air, which are likewiſe new; and, like the reſt, have been made with great preciſion.

Now, though Dr. PRIESTLEY has alſo improved upon this inquiry, by the addition of a variety of experiments; in particular, by ſhewing how this air becomes miſcible with water, and deprived of its inflammability; by comparing

paring it with other ſpecies of factitious air, in regard to conducting the electrical fluid; by inquiring how far it may be conſidered as common air loaded with the principle of fire, called *phlogiſton* by the modern Chemiſts; with other curious obſervations on this ſubſtance: yet all theſe, with other kinds of factitious air, as I have already too long detained you, I muſt with regret paſs over; one other ſpecies excepted, as I reckon it among the moſt brilliant of Dr. PRIESTLEY's diſcoveries [*f*].

This ſpecies he calls the *nitrous air*, without inſiſting on the propriety of the expreſſion. It was firſt produced from the Walton pyrites by means of the ſpirit of nitre. Dr. HALES, who made the experiment, obſerved, that when joined to common air, an efferveſcence enſued, with a turbid red colour of the mixture, and an abſorption of part of the common air [g]. Dr. PRIESTLEY extending the experiment to other metallic ſubſtances obſerved, that the ſame kind of air was by the ſame acid readily procured from iron, copper, braſs, tin, ſilver, quickſilver, biſmuth, and nihil; and that though it conſtantly, when joined to common air, exhibited thoſe appearances mentioned by Dr. HALES, and more conſpicuouſly in proportion to the purity of the common air mixed with it (that is, its fitneſs for reſpiration); yet it made no change with either fixed or inflammable air, or that air tainted by the breath of animals, or the corruption of their bodies. By means of this teſt he was enabled to judge of the kind, as well as of the degree of injury, done to common air by candles burning in it; and to perceive a real difference in the air of his ſtudy, after a few perſons had been with him there. Nay, a phial of air having been ſent him from the neighbourhood of a large town, it appeared upon a comparative trial to be inferior in quality to that taken up near Leeds, where he then reſided. It was upon ſuch a proſpect of obtaining a criterion for diſtinguiſhing good air from bad, that Lord BACON almoſt in a rapture breaks out: "Theſe are noble experiments that can make this diſcovery; for they ſerve for a natural divination of ſeaſons!" and again, "They teach men to chooſe their dwelling for their better health [*h*]."

[*f*] I might have added another new ſpecies of factitious air, which he terms *acid*, firſt taken notice of by Mr. CAVENDISH, and more fully inveſtigated by Dr. PRIESTLEY. This is an elaſtic vapour expelled by heat from ſpirit of ſalt, and not liable afterwards to be condenſed by cold. Water readily imbibes this air, and by that means becomes a ſtrong ſpirit of ſalt. The ſame acid air or vapour, he has alſo diſcovered to be a decompoſer of ſubſtances that contain *phlogiſton*, and with them to form a proper inflammable air.

---

[g] Stat. Eſſ. vol. 2. p. 280.

Nor is this all the uſe of the nitrous air; Dr. PRIESTLEY ſhews it to be one of the ſtrongeſt antiſeptics. The fixed air has been proved by Dr. MACBRIDE, as was remarked, to be powerful in this particular; but this ſpecies of factitious air has been found to be of ſuperior efficacy. And as our author has diſcovered it to be miſcible with water, he has reaſon to believe it may be applied to various purpoſes, ſuch as the preſervation of the more delicate birds, fiſhes, fruits, and anatomical preparations.

I ſhall now conclude with ſhewing from Dr. PRIESTLEY, what reſources Nature has in ſtore againſt the bad effects of corrupted air, which from various cauſes infect our atmoſphere.

[*h*] Nat. Hiſt. Exp. 777.

It is well known that flame cannot long ſubſiſt without a renewal of common air. The quantity of that fluid which even a ſmall flame requires is ſurprizing: an ordinary candle *conſumes*, as it is called, about a gallon of air in a minute. Now, conſidering the vaſt conſumption of this vital fluid by fires of all kinds made by man, and by volcanos, it becomes an intereſting inquiry, to aſcertain what change is made in the air by flame; and to diſcover what proviſion there is in Nature, to repair the injury done by this means to our atmoſphere. Dr. Priestley, after relating the conjectures of others, and not finding them ſatisfactory, was fortunate in falling upon a method of reſtoring air, which had been vitiated by the burning of candles in it. This led the way to the diſcovery of one of the great reſtoratives which Nature employs for this purpoſe; to wit, vegetation: ſee by what induction he proves his opinion.

It was natural to imagine, that ſince the change of common air is neceſſary to vegetable, as well as to animal life, both plants and animals rendered it foul in the ſame manner, ſo as to become unfit for further life and vegetation. But when with that expectation the Doctor had put a ſprig of mint, in a growing and vigorous ſtate, under an inverted glaſs-jar ſtanding in water, he was agreeably diſappointed to find, that this plant not only continued to live, though in a languiſhing way, for two months, but that the confined air was ſo little corrupted by what had iſſued from the mint, that it would neither extinguiſh a candle, nor kill a ſmall animal which he conveyed into it. What further evinced the ſalutary nature of the *effluvia* of vegetables; he found, that air vitiated by a candle left in it till it burnt out, was perfectly reſtored to its quality of ſupporting flame, after another ſprig of mint had for ſome time vegetated in it. And to ſhew that the aromatic vapour of that plant had no ſhare in reſtoring this purity to the air, he obſerved, that vegetables of an offenſive ſmell, and even ſuch as ſcarce had any ſmell at all, but were of a quick growth, proved the very beſt for this purpoſe. Nay more, the virtue of growing vegetables was found to be an antidote to the baneful quality of air corrupted by animal reſpiration and putrefaction.

We have ſaid, that neither candles will burn nor animals live beyond a certain time in a given quantity of air; yet the cauſe of either ſo ſpeedy a death or extinction was unknown; nor was any method diſcovered for rendering that empoiſoned air fit again for reſpiration. Some proviſion however there muſt be in Nature for this purpoſe, as well as for that of ſupporting flame: without ſuch the whole atmoſphere would in time become unfit for animal life, and the race of men as well as beaſts would die of a peſtilential diſtemper. Yet we have reaſon to believe, that in our day the air is not leſs proper for breathing in, than it was above two thouſand years ago; that is, as far as we go back in Natural Hiſtory. Now, for this important end, the Doctor has ſuggeſted, to the Divine as well as to the Philoſopher, two grand reſources of Nature: the vegetable creation again is one, and the ſea and other great bodies of water are the other.

As to the former, having found that plants wonderfully thrive in putrid air, he began to attempt by means of growing vegetables to purify air that had been injured by animal reſpiration and putrefaction; nor was he leſs ſucceſsful than before. Theſe plants were ſure to recover the air to a degree of fitneſs for breathing in it, and that in proportion to their vigour, and the care he took to remove the rotten leaves and branches; which remaining would have marred the operation.

And with regard to the ſecond reſource of Nature, namely the ocean and other waters, Dr. PRIESTLEY having obſerved, that both the air corrupted by the breath of animals, and that vitiated by other putrid matter, was in a good meaſure ſweetened by the ſeptic part infuſing itſelf into water, he concluded, that the ſea, the great lakes and rivers, which cover ſo large a proportion of the globe, muſt be highly uſeful, by abſorbing what is putrid, for the further purification of the atmoſphere:

thus beſtowing what would be noxious to man and other animals, upon the formation of marine and other aquatic plants, or upon other purpoſes yet unknown.

From theſe diſcoveries we are aſſured, that no vegetable grows in vain, but that from the oak of the foreſt to the graſs of the field, every individual plant is ſerviceable to mankind; if not always diſtinguiſhed by ſome private virtue, yet making a part of the whole which cleanſes and purifies our atmoſphere. In this the fragrant roſe and deadly nightſhade co-operate: nor is the herbage, nor the woods that flouriſh in the moſt remote and unpeopled regions unprofitable to us, nor we to them; conſidering how conſtantly the winds convey to them our vitiated air, for our relief, and for their nouriſhment. And if ever theſe ſalutary gales riſe to ſtorms and hurricanes, let us ſtill trace and revere the ways of a beneficent Being; who not fortuitouſly but with deſign, not in wrath but in mercy, thus ſhakes the waters and the air together, to bury in the deep thoſe putrid and peſtilential *effluvia*, which the vegetables upon the face of the earth had been inſufficient to conſume.

THIS, GENTLEMEN, is what I had to ſay upon the occaſion: perhaps too much; but the fruitfulneſs of the ſubject, with my earneſt deſire of commemorating ſome of the more important experiments and concluſions of Dr. PRIESTLEY, and of thoſe who preceded him in theſe inquiries, will, I hope, plead my excuſe. Nor can I conclude without congratulating this illuſtrious Body on the poſſeſſion of ſo many members and friends, ſo capable to promote the great ends of this inſtitution; and who have within theſe few years ſo eminently diſtinguiſhed themſelves, by the lights they have thrown, not only upon this, but upon other of the more ſubtile fluids of Nature. You will underſtand, that to theſe diſcoveries upon factitious air, I join thoſe amazing ones upon magnetiſm and electricity, with all the uſes reſulting from them. Here you will recollect the prediction of him, who beſt taught the method of inveſtigating philoſophical truth, the incomparable Lord BACON, who, with that ſpirit of divination peculiar to exalted genius, aſſured his diſciples, that when men ſhould ceaſe to trifle in framing *hypotheſes*, and building haſty ſyſtems; and ſhould by a proper induction from ſober and ſevere experiments attain to the knowledge of the *forms* of things [their more intimate qualities and laws] they ſhould in the end command Nature, and perform works as much greater than were ſuppoſed practicable by the powers of natural magic, as the real actions of a *Cæſar* ſurpaſſed the fictitious ones of the hero of a romance [*i*]. Some earneſt, nor that inconſiderable, of this magnificent promiſe this Society has already obtained. Let thoſe who doubt, view that Needle, which, untouched by any loadſtone, directs the courſe of the Britiſh mariner round the world; or that apparatus, ſo perfectly imitating the long ſuppoſed inimitable lightning; or that other, which diſarms the clouds of that tremendous meteor: or (not to depart from my ſubject) let them ſee how Art can from chalk only, the leaſt promiſing ſubſtance, generate, call it unfetter a copious elaſtic fluid impriſoned in it, the poiſon of man, or his medicine, according to the mode of application; which, though inviſible, yet diſſolves earth and metals, and imparts the ſpirit and virtue to the moſt prized of mineral waters. Yet theſe are but inventions of yeſterday: I would ſtrictly ſay, inventions within the memory of my youngeſt hearer. If to theſe late acquiſitions, ſo honourable to this Society, I add thoſe in Natural Hiſtory, by the zeal and unwearied attention of ſome worthy members, who have extended your correſpondence and adorned your Muſeum; and by thoſe other gentlemen, who, animated with a noble ſpirit, have, to their laſting honour, undertaken the moſt dangerous and moſt diſtant voyages in purſuit of Natural Knowledge: I ſay, when to the progreſs you are making in Experimental Philoſophy, I add that in the Hiſtory of Nature, every true lover of ſcience will rejoice to think, that your affairs have not, perhaps, at any period, been in a more flouriſhing condition.

[*i*] Compare Bac. De Dignit. et Augment. Scient. lib 3. cap. 5.

Dr. Priestley,

It is now time that, in the name and by the authority of the Royal Society of London, inſtituted for the improvement of Natural Knowledge, I preſent you with this medal, the palm and laurel of this Community; as a faithful and unfading teſtimonial of their regard, and of the juſt ſenſe they have of your merit, and of the perſevering induſtry with which you have promoted the views, and thereby the honour of this Society. And in their behalf I muſt earneſtly requeſt you, to continue thoſe liberal and valuable inquiries, whether by further proſecuting this ſubject, probably not yet exhauſted, or by inveſtigating the nature of ſome other of the ſubtile fluids of the univerſe. You will remember, that *Fire*, the great inſtrument of the Chemiſts, is but little known even to themſelves; and that it remains a *Query*, what was by the moſt celebrated of philoſophers propoſed as ſuch, whether there be not a certain fluid (he calls it *Æther)* the cauſe of gravity, the cauſe of the various attractions, and of the animal and vital motions [k]. Theſe, Sir, are indeed large demands: but the Royal Society have hitherto been fortunate in their pneumatic reſearches. And were it otherwiſe, they have much to hope from men of your talents and application, and whoſe paſt labours have been crowned with ſo much ſucceſs.

---

[k] Newton's Optics, Quer. 18—24.

⁂

ERRATA.

P.	L.	
3.	19.	for *fire, and* r. *fire; and they ſaw*
7.	7.	for *breathed* r. *attempted to breathe*
12.	5.	for *he* r. *Mr.* LANE
16.	9.	after *order* r. *that*
29.	17.	for *with* r. *by*